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(54) Title: SRNS RELOCATION IN A UMTS NETWORK
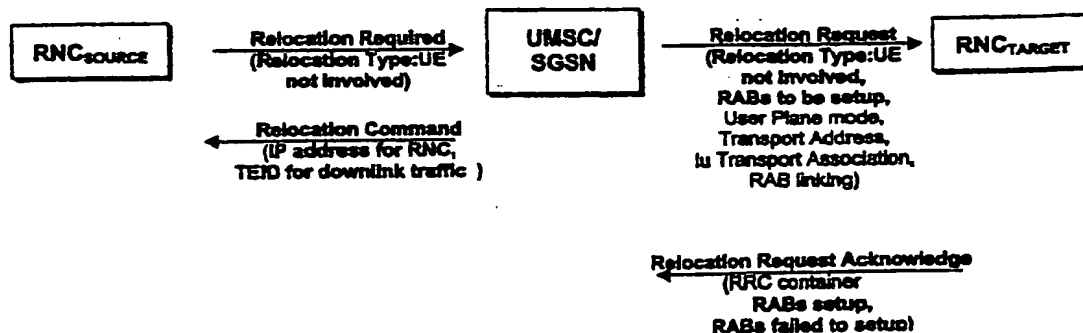
(57) Abstract: A method of performing a SRNS Relocation in a UMTS network for a given UE, the method comprising sending a Relocation Required message from the serving RNC to the core network and sending a Relocation Request message from the core network to the target RNC, the Relocation Required message containing a RRC Initialisation Information container which is incorporated transparently by the core network into the Relocation Request message, and the RRC Initialisation Information container in turn containing information enabling a mapping to be made between RABs and RBs for the UE.

SRNS Relocation in a UMTS network

Field of the Invention

5   The present invention relates to SRNS Relocation in a UMTS network and more
particularly to the transfer of radio resources between a SRNS and a target RNS during
such Relocation.

Background to the Invention

10

Figure 1 illustrates schematically a part of a Universal Mobile Telecommunications
System (UMTS) network. The network includes a core network part 1, which may be a
network handling voice calls using UMTS Mobile-services Switching Centres (UMSCs)
or may be a data network such as a General Packet Radio Service (GPRS) network
15   including Serving GPRS Support Nodes (SGSNs). In Figure 1 the UMSCs and SGSNs
are indicated generally with the reference numeral 2. A subscriber or User Equipment
(UE) 3 is coupled to the core network 1 via an access network 4 referred to as a
Universal Terrestrial Radio Access Network (UTRAN). More particularly, the
UMSCs/SGSNs 2 are connected to Radio Network Controllers (RNCs) 5,6 of the
20   UTRAN 4 over an interface referred to as the Iu interface.

Each RNC 5 forms part of a Radio Network Subsystem (RNSs) 7,8 which also
comprises a set of Base Transceiver Stations 9 referred to in UMTS terminology as
Node B's. The interface between a RNC 5,6 and a Node B 9 is known as the Iub
25   interface. A node B 9 provides the connection point for a UE 3 to the UTRAN 4, and
the interface between the Node B 9 and the UE 3 is known as the Uu interface. The
RNS (RNS 7 in Figure 1) which connects a UE 3 to the core network 1 at any given
time is referred to as the Serving RNS (SRNS) for that particular UE 3.

30   Figure 2 illustrates in very general terms the bearer structure used by UTRAN to carry
user data between the UE 3 and the core network 1. When it is required to establish a
user plane connection, the responsible UMSC or SGSN 2 instructs the UTRAN 4 to
establish a logical connection between the UMSC or SGSN 2 and the UE 3. This

logical connection is referred to as a Radio Access Bearer (RAB). The established RAB inherits requirements of the requested UMTS service, e.g. Quality of Service, etc. Based on the inherited requirements of the RAB, the RNC 5,6 establishes user plane connections with the core network 1 (i.e. UMSC or SGSN 2) and with the UE 3. The

5   connection between the RNC 5,6 and the core network 1 is referred to as the Iu bearer whilst the connection between the RNC 5,6 and the UE 3 is referred to as the Radio Bearer (RB). Both of these bearers represent further logical channels, with the RNC performing a mapping between them. The bearers themselves are mapped onto appropriate traffic channels for transmission over the respective interfaces (Iu and Uu).

10

A single UE 3 may be associated with one or more RABs. For example, a UE 3 may simultaneously make use of one RAB established for a voice call, and another RAB established for a data call. The RNC 5,6 uses RAB identifiers (allocated by the core network) to distinguish between these different RABs. In the same way, a RB identity

15   is used to distinguish between RBs. During the setting-up of a new user plane connection, a RAB and a RB are implicitly associated with one another by the RNC.

An important feature of mobile telecommunication systems is the ability to allow subscribers to move within (and outside) particular networks. This often requires a

20   process known as SRNS relocation, in which an existing SRNS is replaced by a target RNS. Considering a scenario known as Hard Handover where a UE moves out of the area of responsibility of a first RNS, into a new RNS, it is necessary that the RNC (i.e. the Serving RNC (RNCs)) of the SRNS be replaced by the RNC (referred to during the transition phase as the Target RNC (RNCT)) of the second RNS, as the access RNC for

25   the UE. In some circumstances, the Target RNC may immediately become the Serving RNC, with the user plane connection being established between the Target RNC and the core network. In other circumstances, the user plane connection extends between the Target RNC (which is thereafter referred to as a "drift" RNC) and the core network via the Serving RNC, where the interface between the drift RNC and the Serving RNC is

30   known as the Iur interface. The network may subsequently decide to convert the drift RNC into the Serving RNC, establishing a direct user plane connection to the core network.

In either scenario, the SRNS relocation process may be initiated by the Serving RNC sending to the core network (UMSC or SGSN) a Relocation Required message. This message is currently defined in the Radio Access Network Application Part (RANAP) protocol (UMTS TS 25.413) and carried over the Iu interface. The core network

5   responds to receipt of a Relocation Required message by sending a Relocation Request message to the Target RNC. The Relocation Request message is also defined in the RANAP protocol.

The Relocation Request message contains the identities of the RABs to be transferred.

10   Both the Relocation Request message and the Relocation Required message contain an RRC Initialisation Information container. This container is defined in the Radio Resource Control (RRC) protocol (UMTS TS 25.331), and contains amongst other things the identities of the RBs to be transferred as well as details of the mappings between the RBs and the lower layer attributes, i.e. to logical, transport, and physical

15   channels. It is noted that the RB identities and the mappings between the RBs and the lower layer attributes are contained in a container which is passed transparently by the core network.

Summary of the Invention

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The inventors of the present invention have recognised that in order to deal with a SRNS Relocation situation for a given UE, where that UE has multiple RABs allocated to it, the Target RNC must have a knowledge of the mappings between the RABs and the RBs. Under the current proposal, neither the Relocation Request message nor the

25   Relocation Required message contain sufficient information to perform this mapping. The result is that confusion might arise at the Target RNC, with the Target RNC associating RBs with the wrong RABs. In such a situation, calls may be incorrectly connected and resources allocated inappropriately.

30   According to a first aspect of the present invention there is provided a method of performing a SRNS Relocation in a UMTS network for a given UE, the method comprising sending a Relocation Required message from the Serving RNC to the core network and sending a Relocation Request message from the core network to the Target

RNC, the Relocation Required message containing a RRC Initialisation Information container which is incorporated transparently by the core network into the Relocation Request message, and the RRC Initialisation Information container in turn containing information enabling a mapping to be made between RABs and RBs for the UE.

Preferably, where an RRC Initialisation Information container contains a Radio Bearer Information element, said mapping comprises for each RB, a RAB identity to which that RB corresponds, the RABs and the RBs being identified by RAB and RB identifiers respectively.

The mapping information contained in the RRC Initialisation Information container may comprise NAS binding information.

According to a second aspect of the present invention there is provided UMTS telecommunications system comprising at least one core network and a UTRAN, the UTRAN comprising a plurality of RNCs, pairs of which are arranged to communicate with each other, via said core network, in the event of SRNS Relocation, each RNC being arranged to generate and send a Relocation Required message to the core network in the event that the RNC is the pre-existing SRNS for a UE, the Relocation Required message containing a RRC Initialisation Information container which in turn contains a mapping information enabling a mapping to be made between RABs and RBs for the UE, and each RNC being arranged to receive a Relocation Request message from the core network in the event that the RNC is the Target RNC, the Relocation Request message containing said RRC Initialisation Information container.

It will be appreciated that the core network is arranged to translate a received Relocation Required message into a Relocation Request message for transmission to the Target RNC. The RRC Initialisation Information container is copied transparently in this process.

Brief Description of the Drawings

Figure 1 illustrates schematically a UMTS network;

Figure 2 illustrates schematically the bearer structure used in the UTRAN part of the
UMTS network of Figure 1;

Figure 3 illustrates a precondition for SRNS relocation in the UMTS network of Figure
1;

5 Figure 4 illustrates a precondition for a SRNS Hard Handover in the UMTS network of
Figure 1;

Figure 5 illustrates the condition after SRNS Relocation/Hard Handover in the UMTS
network of Figure 1, following the preconditions of either Figure 3 or Figure 4;

Figure 6 illustrates signalling at a general level at SRNS Relocation/Hard Handover in

10 the network of Figure 1, as well as the structure of Relocation messages; and

Figure 7 illustrates on a more detailed level the signalling of Figure 6.

Detailed Description of a Preferred Embodiment

15 A typical UMTS network has been described above with reference to Figure 1, whilst
the UTRAN bearer structure employed in such a network has been described with
reference to Figure 2.

Figure 3 illustrates a situation in which User Equipment (UE) is connected to a

20 UMSC/SGSN of a core network of a UMTS network, via a drift RNC 10 and a Serving
RNC 11. The "active" connection is illustrated by the broken lines in Figure 3. Such a
situation may arise after the UE has initiated a connection via the Serving RNC 11 and
has subsequently moved into the coverage area of the drift RNC 10. Figure 4 illustrates
a situation in which a UE is coupled to a UMSC/SGSN of a core network via only a

25 Serving RNC 11, with the broken lines again illustrating the active connection.

As described above, under certain circumstances the situation illustrated in Figure 3
may be a precondition for a SRNS Relocation, where the network decides to transfer the
user plane connection between the core network and the UTRAN, from the SRNS to the

30 RNS which contains the drift RNC 10. The situation which exists following such a
relocation is illustrated in Figure 5, where the broken lines illustrate the new active
connection. Figure 5 also corresponds to the situation which exists following a Hard
Handover and associated Relocation from the precondition illustrated in Figure 4, or

following a Hard Handover in which the "structure" of Figure 4 is transformed to that of Figure 3 and a SRNS relocation subsequently occurs resulting in the structure of Figure 5.

5   The Relocation process is initiated by the sending of a Relocation Required message from the RNC of the SRNS (RNC_S) to the core network over the Iu interface using the RANAP protocol. This is illustrated in Figure 6, as is the general structure of the Relocation Required message (defined in the RRC specification). As well as including an identification of the Serving RNC and the target RNC, the message contains a Source

10   RNC to target RNC transparent container. The container includes a set of Radio Bearer Information Elements, one for each Radio Bearer (RB) to be transferred. Each element contains an RB identity, RLC identity, and RB mapping information. Notably, the RB mapping information includes the identity of the RAB which is associated with the RB in question.

15

The UMSC or the SGSN which receives the Relocation Required message reacts to the message as defined in the RANAP protocol. In particular it produces a Relocation Request message which is forwarded to the target RNC via the UMSC/SGSN to which the target RNC is connected (in some cases both the Serving and the target RNCs may

20   be connected to the same UMSC/SGSN). This is again illustrated in Figure 6, together with the structure of the Relocation Request message. As well as the RAB Ids to be transferred (i.e. setup be the target RNC), the message includes the Source RNC to target RNC transparent container which is passed transparently by the core network.

25   Upon receipt of the Relocation Request message, the target RNC must establish an appropriate bearer structure (Figure 2) between the UE and the core network. Based upon the information contained in the Relocation Request message, the required RABs are setup and the Iu bearers established. The target RNC then examines the contents of the Radio Bearer Information Elements of the transparent container. This information

30   tells the target RNC which RBs are related to which RABs (nb. whilst there may be a one to one mapping between RBs and RABs, this need not be the case and a single RAB may be mapped to two or more RBs).

Figure 7 illustrates in more detail the signalling involved in a SRNS Relocation. In addition to the Relocation Request and Relocation Request messages, a Relocation Command message is returned from the core network to the RNC_S, whilst a Relocation Request Acknowledgement message is returned from the RNC_T to the core network.

5

It will be appreciated by the person of skill in the art that various modifications may be made to the above described embodiments without departing from the scope of the present invention. For example, under current proposals, NAS binding information is used at RAB assignment request to associate a call in the control plane (e.g. SETUP)

10   and in the user plane. The NAS binding information may be required to make a control plane/user plane association possible in the case of a Hard Handover, in which case the Source RNC to target RNC transparent container could contain NAS binding information. The NAS binding information would then allow the Target RNC to map RBs to RABs.

Claims

1.   A method of performing a SRNS Relocation in a UMTS network for a given
UE, the method comprising sending a Relocation Required message from the serving

5   RNC to the core network and sending a Relocation Request message from the core
network to the Target RNC, the Relocation Required message containing a RRC
Initialisation Information container which is incorporated transparently by the core
network into the Relocation Request message, and the RRC Initialisation Information
container in turn containing information enabling a mapping to be made between RABs

10   and RBs for the UE.

2.   A method according to claim 1, wherein, where an RRC Initialisation
Information container contains a Radio Bearer Information element, said mapping
comprises for each RB a RAB identity to which that RB corresponds, the RABS and the

15   RBs being identified by RAB and RB identifiers respectively.

3.   A method according to claim 1, wherein the mapping information contained in
the RRC Initialisation Information container comprises NAS binding information.

20   4.   A UMTS telecommunications system comprising at least one core network and
a UTRAN, the UTRAN comprising a plurality of RNCs, pairs of which are arranged to
communicate with each other, via said core network, in the event of a SRNS Relocation,
each RNC being arranged to generate and send a Relocation Required message to the
core network in the event that the RNC is the pre-existing SRNC for a UE, the

25   Relocation Required message containing a RRC Initialisation Information container
which in turn containing information enabling a mapping to be made between RABs
and RBs for the UE, and each RNC being arranged to receive a Relocation Request
message from the core network in the event that the RNC is the target RNC, the
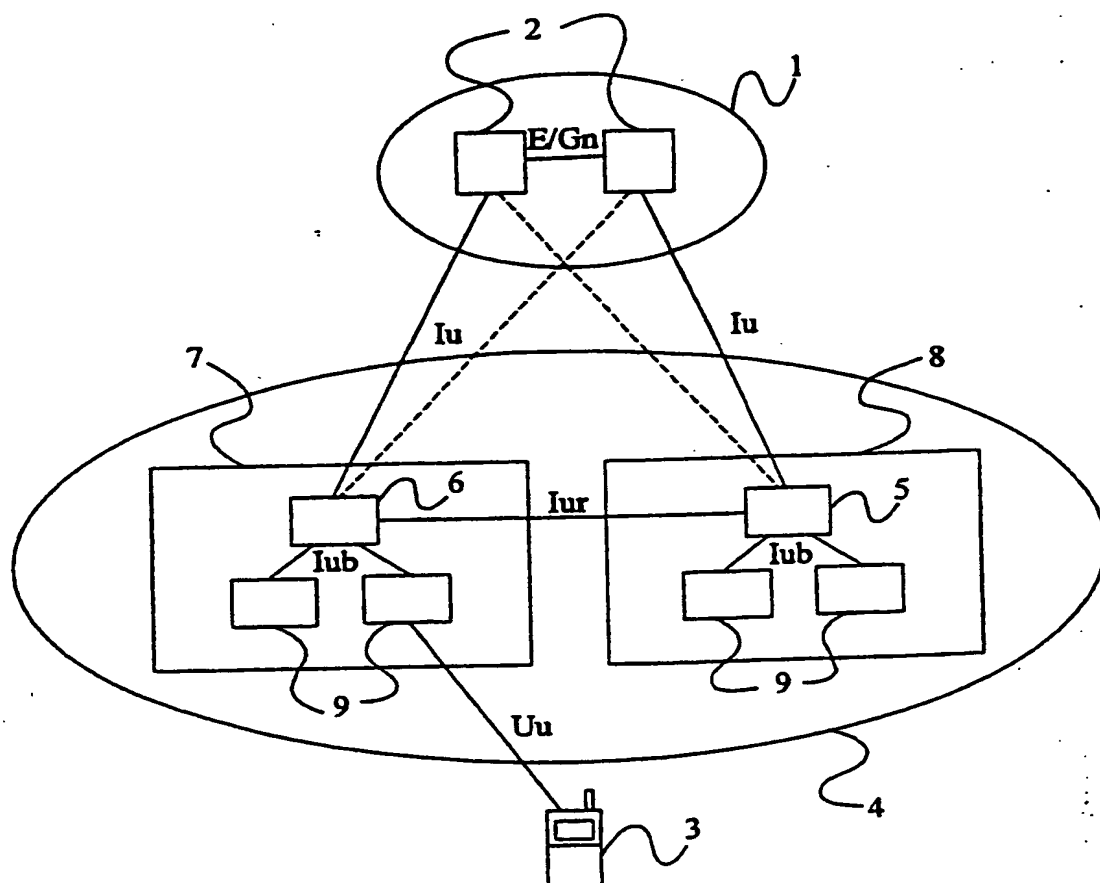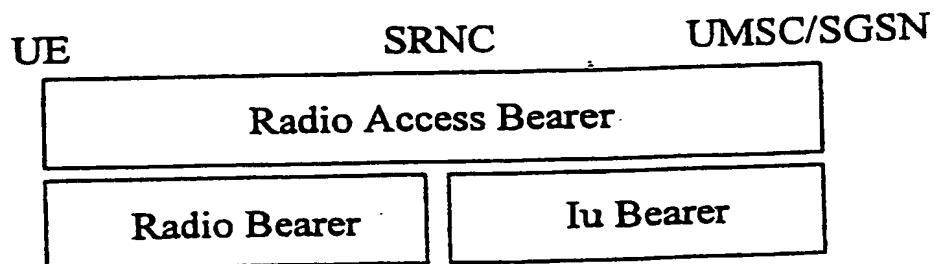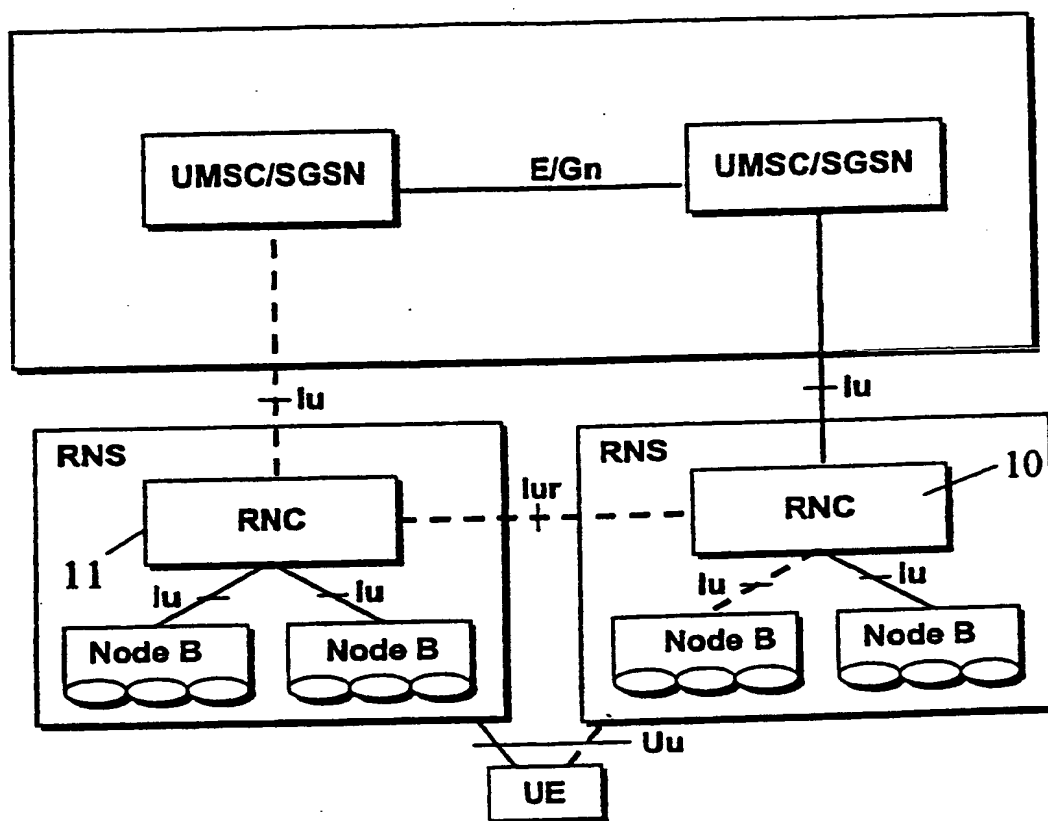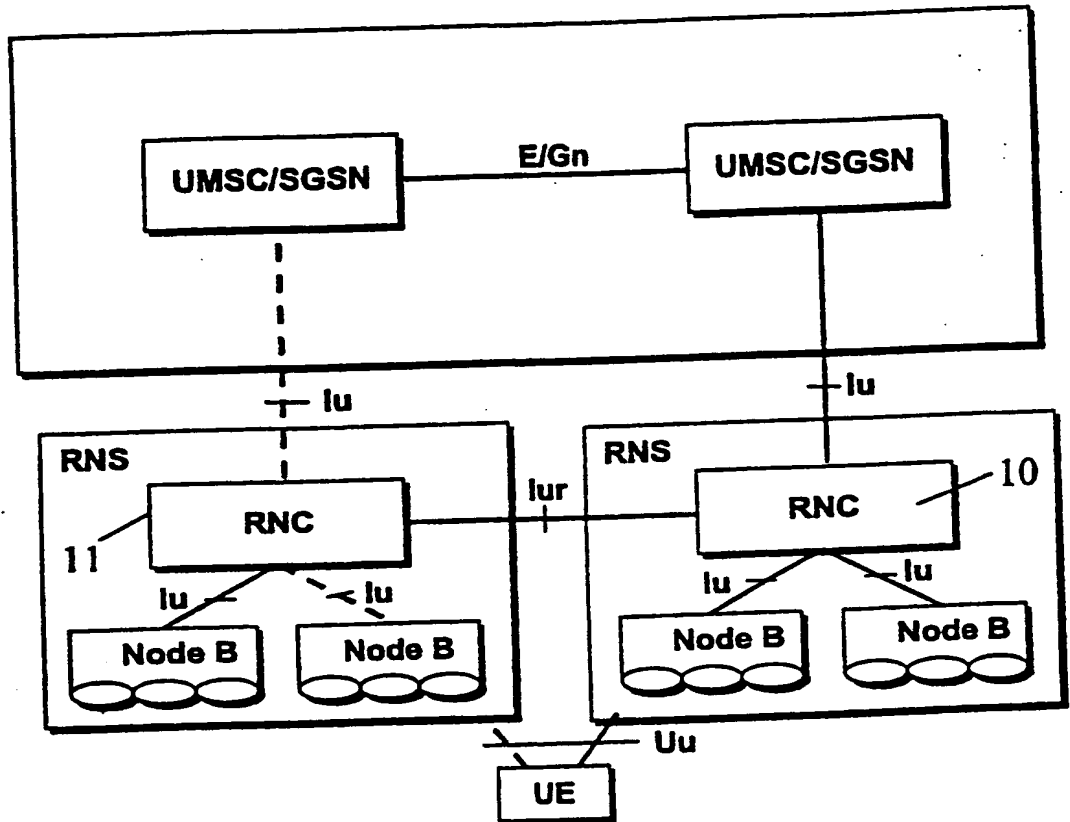Relocation Request message containing said RRC Initialisation Information container.

30

Figure 1

Figure 2

Figure 3

<u>Figure 4</u>

Figure 5

RNC_S → Relocation Required → CN → Relocation Request → RNC_T
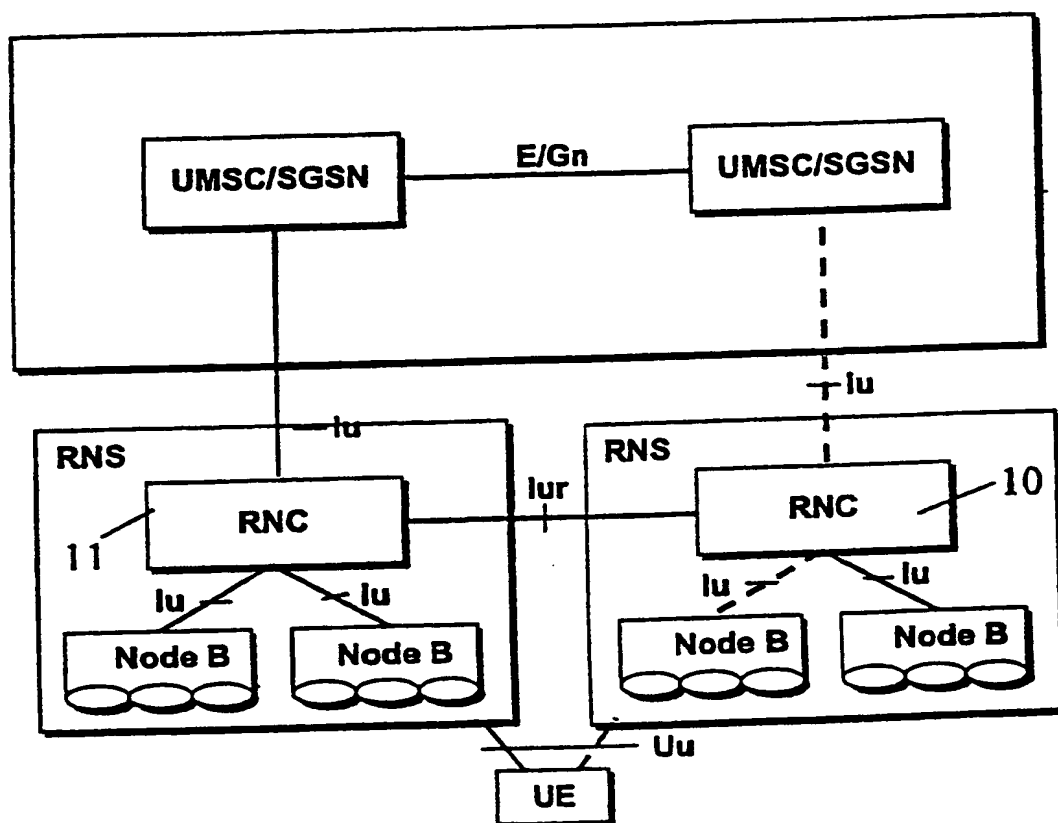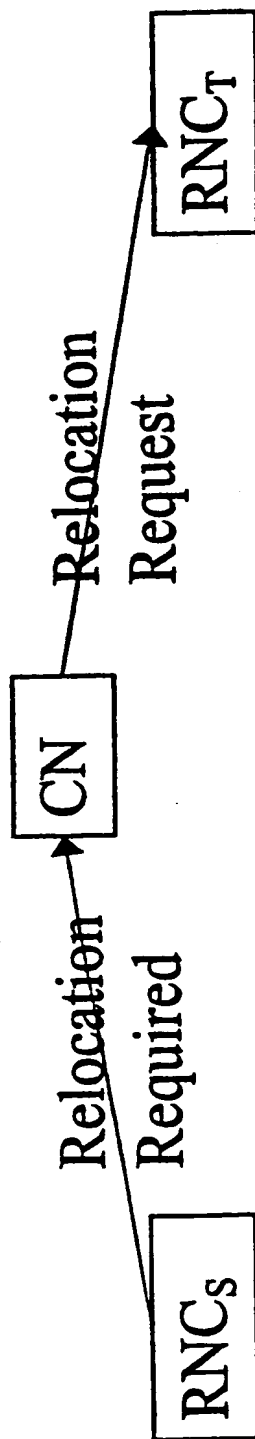
Relocation Required

IE/Group Name
Message Type
Relocation Type UE involved/UE not involved
Cause
Source ID
Target ID
Source RNC to target RNC transparent container

Relocation Request

IE/Group Name
Message Type
Relocation Type UE involved/UE not involved
Cause
Source RNC to target RNC transparent container
RABs to be setup
RAB ID
RAB parameters
User Plane mode
Transport Address
Iu Transport Association
RAB linking

Figure 6
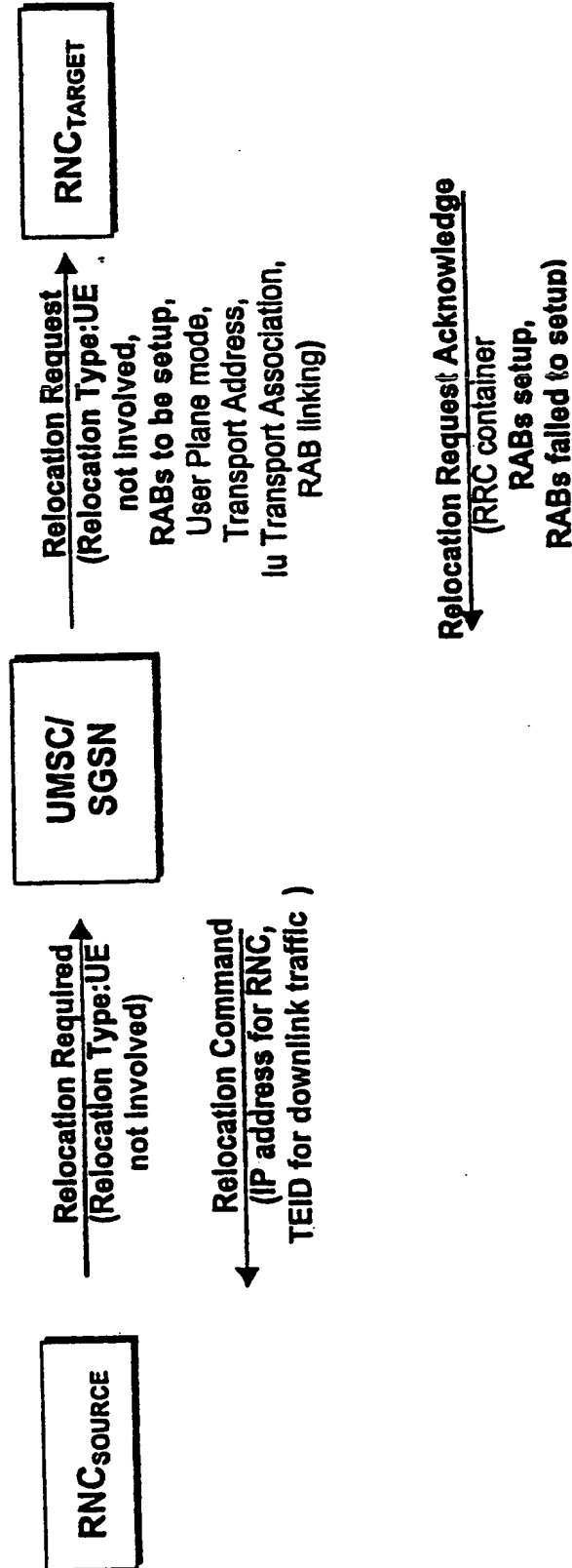
Figure 7

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99 51051 A (NOKIA TELECOMMUNICATIONS OY ;AHMAVAARA KALLE (FI)) 7 October 1999 (1999-10-07) page 4, line 23 -page 7, line 10; figures 4,5 ———	1,4
P,A	ETSI: "TS 125 413 Universal Mobile Telecommunications System (UMTS); UTRAN Iu Interface RANAP Signalling (3G TS 25.413 Version 3.0.0 Release 1999)" ETSI, January 2000 (2000-01), pages 1-147, XP002165163 Valbonne, FR cited in the application paragraph '0007! paragraph '8.6.3! paragraph '8.7.2! ———	1,4

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 April 2001	04/05/2001

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INTERNATIONAL SEARCH REPORT

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
P,A	ETSI: "TS 125 331 Universal Mobile Telecommunications System (UMTS); RRC Protocol Specification (3G TS 25.331 Version 3.1.0 Release 1999)" ETSI, January 2000 (2000-01), pages 1-282, XP002165164 Valbonne, Fr cited in the application paragraph '0007! paragraph '8.2.1! – paragraph '8.2.1.2! paragraph '8.2.2! – paragraph '8.2.2.1! paragraph '8.3.5! – paragraph '8.3.6.5!	1,4

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International Application No

PCT/EP 00/11010

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